Modeling and Simulation In Support of T&E and Acquisition

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Unknown Unknowns

Known Knowns	**Unknown Knowns**
Known Unknowns	**Unknown Unknowns**

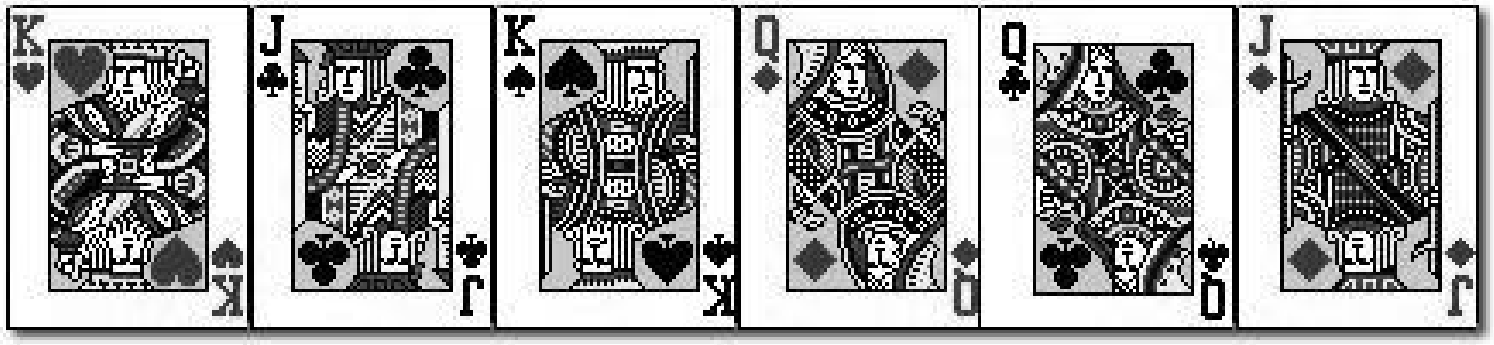
Compartmentalization vs. Aggregation

- Fault isolation is essential
- Disintegration - modularity
- Use coupled modeling only when critical parameters are truly coupled.
- Being able to integrate modeling tools is no substitute for understanding what is coupled and what is not

The Magic of M&S

- As an illustration
- I would like everyone to make a selection from the list I will present
- We will not have much time
- You will be asked to identify your selection later so remember it.

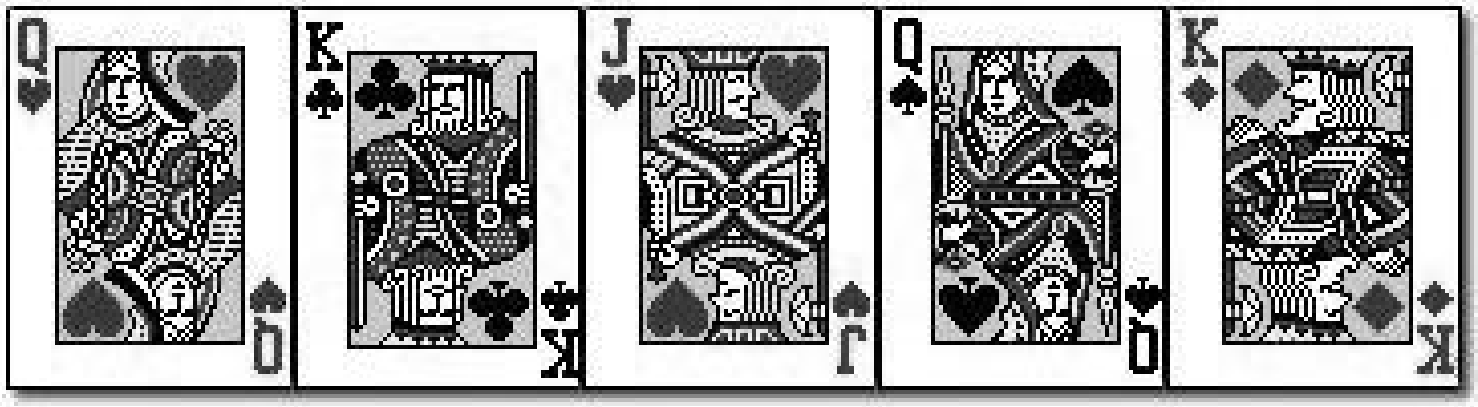
Pick a Card



The Test

- One card from the list has been removed
- The missing card will be yours
- I hope you remembered your selection because testing is expensive

Success or Failure?



M&S: A Science

- The Scientific Method is based on model building (hypothesis formation).
- What is often lacking is the rigorous testing of the model.
- M&S provides an intellectual framework in which to evaluate data.
- Answer - What does the system do? NOT

  Does the system do this?

Goal: To develop experience from models and not models from experience.

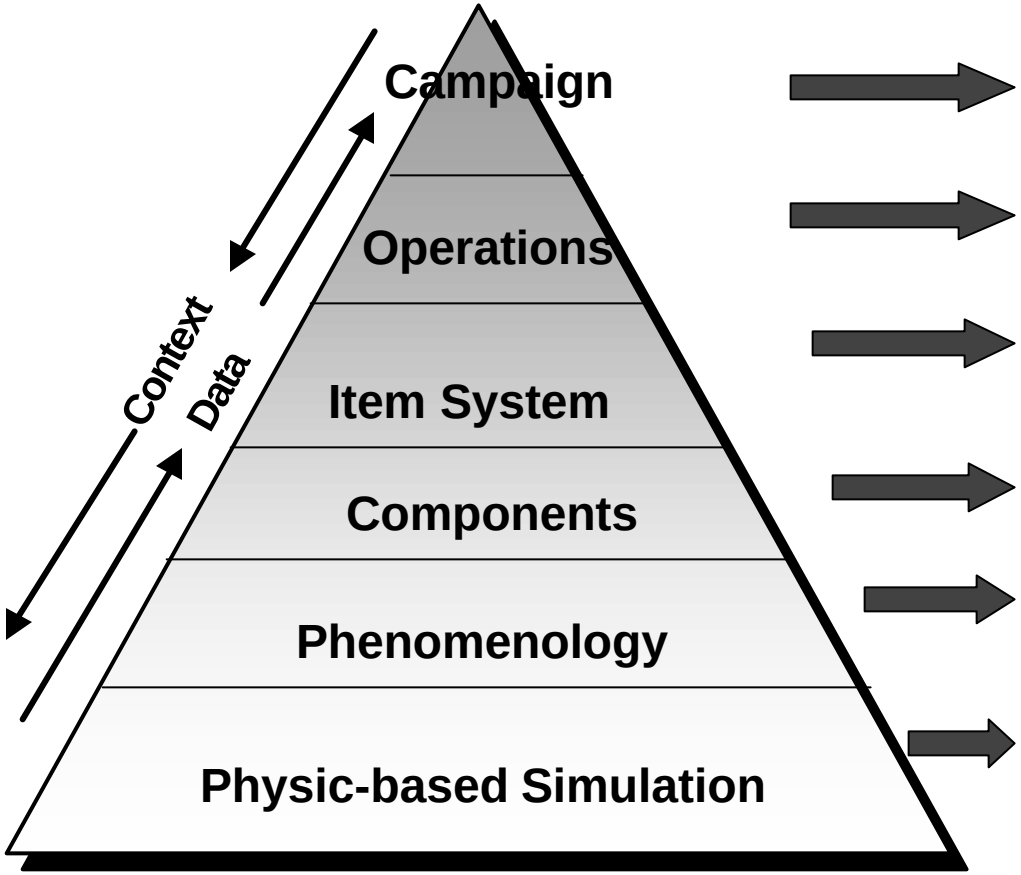
Simulation Based Acquisition (SBA)

- **"An integrator of simulation tools and technology across acquisition functions and program phases and across programs. It is a concept in which M&S as a resource is more efficiently managed in the acquisition process. In a defense environment of decreased funding, SBA addresses both the decreasing availability of resources for system development and the increasing power of M&S tools.[46]"**

Simulation Based Acquisition Road Map
December 1998

Total System Assessment Integrated M&S from Physics to Campaign

Models and Analysis Hierarchy



Acquisition Process Issues

Force Structure
(many on many)

Force Utility

Interoperability
(few on few)

Battle Utility

Performance
(platforms)

Response
(macro-models)

Effects
(lethality/vulnerability)

Probability of Hit

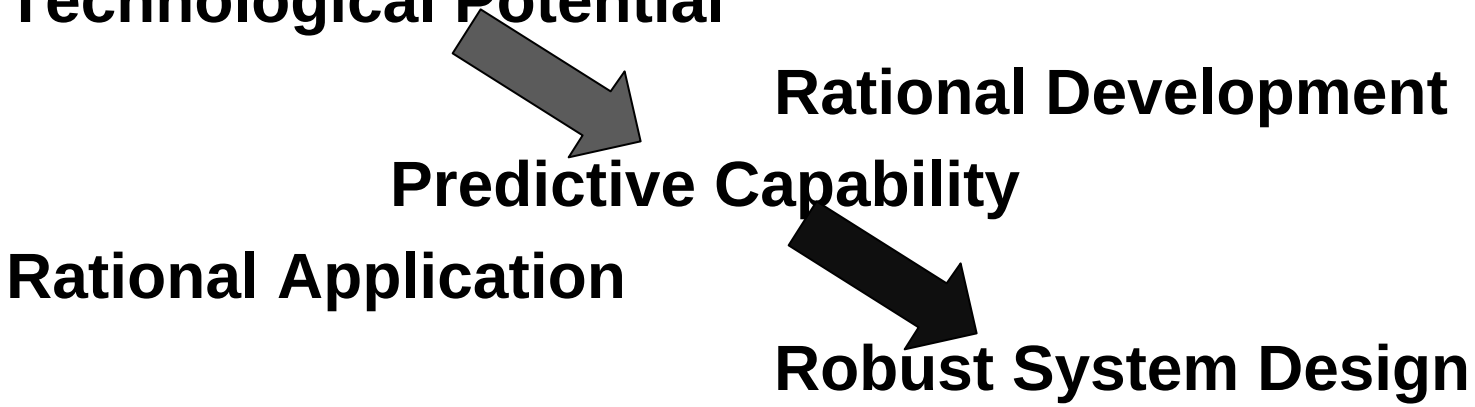
Physics
(materials, fluid dynamics, etc.)

Probability of Damage or Kill

Appropriate Mix of M&S and T&E - Margin

- M&S is widely accepted in applications with high margin
- Complexity in system functionality and mission profile reduce margin
- As margin decreases so does the appropriate ratio of M&S/T&E
- This does not imply that M&S is unimportant but rather that the potential for unknown unknowns increases
- How do we know when we are done?

R to D to A
HPC - M&S - SBA



- Bring focus to M&S development and use by concentrating on weapon technology not modeling or computing technology

DMSO Computational Technology Areas

- Computational Fluid Dynamics (CFD)
- Climate / Weather / Ocean M&S (CWO)
- Computational Electromagnetics and Acoustics (CEA)
- Computational Chemistry and Material Science (CCM)
- Integrated Modeling and Test Environments (IMT)
- Computational Structural Mechanics (CSM)
- Environmental Quality M&S (EQM)
- Computational Electronics and Nanoelectronics (CEN)
- Forces Modeling and Simulation (FMS)
- Signal / Image Processing (SIP)

Not Just High Fidelity but Highly Credible